What is claimed is:

1. An implantable electrode, which comprises:
   a) a substrate;
   b) a biocompatible and electrically conductive catalyzing coating supported on the substrate; and
   c) a multiplicity of carbon-containing nanotubes adhering to the coating.

2. The electrode of claim 1 wherein the substrate is selected from the group consisting of tantalum, titanium, zirconium, iridium, platinum, and niobium.

3. The electrode of claim 1 wherein the coating is selected from the group consisting of tantalum, titanium, zirconium, iridium, platinum, niobium, and nitrogen-doped carbon.

4. The electrode of claim 3 wherein the nitrogen in the nitrogen-doped carbon is provided at a concentration of about 1 to about 57 atomic percent.

5. The electrode of claim 1 wherein the coating is selected from the group consisting of a nitride, a carbide, a carbonitride, and an oxide of the group of tantalum, titanium, zirconium, iridium, platinum, and niobium.

6. The electrode of claim 1 wherein the nanotubes are in a form selected from the group consisting of single-wall nanotubes, multi-wall nanotubes, nanotube ropes, carbon whiskers, and combinations thereof.

7. The electrode of claim 1 wherein the nanotubes are of carbon-doped boron nitride.

8. The electrode of claim 1 wherein the nanotubes are characterized as having been grown from a reaction gas selected from the group consisting of acetylene, methyl acetylene-propadiene, and a gas of the paraffin series.

9. The electrode of claim 8 wherein the reaction gas is characterized as having an ammonium addition.

10. The electrode of claim 1 comprising the nanotubes adhering to tantalum coated on a titanium substrate.

11. A method for providing an implantable electrode, comprising the steps of:

a) providing a substrate;

b) coating a catalytic material selected from the group consisting of nitrogen-doped carbon, tantalum, titanium, zirconium, iridium, platinum, and niobium or a nitride, a carbide, a carbonitride, and an oxide thereof on the substrate;

c) heating the coated substrate;

d) contacting the heated substrate with a flowing hydrogen-containing gas stream to thereby provide carbon-containing nanotubes on the coated substrate; and

e) utilizing the nanotube coated substrate as an implantable electrode.

12. The method of claim 11 including heating the coated substrate to a temperature of about 350°C to about 1,150°C.

13. The method of claim 11 including cooling the nanotube coated substrate in hydrogen prior to use.

14. A method of providing an implantable electrode, comprising the steps of:

a) providing a substrate;

b) providing nanotubes mixed with a binder precursor selected from chloroiridic acid, chloroplatinic acid, titanium (IV) chloride, zirconium (IV) chloride, niobium (V) chloride, and tantalum (V) chloride in a solvent;

c) contacting the binder precursor to the substrate;

d) converting the binder precursor to coating on the substrate having the nanotubes embedded therein.

15. The method of claim 14 including heating the binder precursor coated substrate in either an oxidizing or an inert atmosphere.

16. The method of claim 14 including heating the binder precursor coated substrate at a temperature of about 300°C to about 500°C.

17. The method of claim 14 including heating the binder precursor coated substrate for a time ranging from about 30 minutes to about 3 hours.

18. The method of claim 14 including heating the chloroiridic acid binder precursor in an oxidizing atmosphere to provide the nanotubes embedded in an iridium oxide binder coated on the substrate.

19. The method of claim 14 including heating the chloroplatinic acid, titanium (IV) chloride, zirconium (IV) chloride, niobium (V) chloride, and tantalum (V) chloride binder precursors in an inert atmosphere to provide the nanotubes embedded in a binder of platinum, titanium, zirconium, niobium, and tantalum, respectively, coated on the substrate.

20. A method for providing an implantable electrode, comprising the steps of:

a) providing a substrate;
b) coating a carbonaceous catalytic material on the substrate;
c) heating the carbonaceous coated substrate;
d) contacting the heated substrate with a flowing hydrogen-containing gas stream to thereby provide carbon-containing nanotubes on the carbonaceous coated substrate; and
e) utilizing the nanotube coated substrate as an implantable electrode.

21. The method of claim 20 including heating the carbonaceous coated substrate to a temperature of about 350°C to about 1,150°C.

22. The method of claim 20 including sputtering the carbonaceous catalytic material on the substrate.

23. The method of claim 20 including providing the sputtered carbonaceous catalytic material as nitrogen-doped carbon.

24. The method of claim 20 including providing the nitrogen in the nitrogen-doped carbon at a concentration of about 1 to about 57 atomic percent.

25. A method for providing an implantable electrode, comprising the steps of:

a) providing a substrate;

b) coating a catalytic material selected from the group consisting of nitrogen-doped carbon, tantalum, titanium, zirconium, iridium, platinum, and niobium or a nitride, a carbide, a carbonitride, and an oxide thereof on the substrate;

c) subjecting the coated substrate to a plasma assisted chemical vapor deposition process containing a flowing hydrocarbon-containing gas stream to thereby provide carbon-containing nanotubes on the coated substrate; and

d) utilizing the nanotube coated substrate as an implantable electrode.

26. The method of claim 25 including utilizing microwave excitation in the plasma assisted chemical vapor deposition process.